Value Assignment and Uncertainty Evaluation for Samples Used in VDSP Interlaboratory and Commutability Studies

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VDSP Single Donor Samples

ANALYTICAL PROCEDURES

- For each of 50 single donor samples of serum, and for each of three analytes:
  - Ghent did one injection per sample work-up and prepared three sample work-ups
  - NIST did two injections per sample work-up, and prepared two sample work-ups

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LIMITS OF QUANTITATION

- For the concentrations of $25(OH)D_2$, $25(OH)D_3$, and 3-epi-$25(OH)D_3$:
  - Ghent: $0.6\,ng\,mL^{-1}$
  - NIST: $0.5\,ng\,g^{-1}$ for 25 samples measured by one chemist, and $1.0\,ng\,g^{-1}$ for the other 25 samples measured by another chemist

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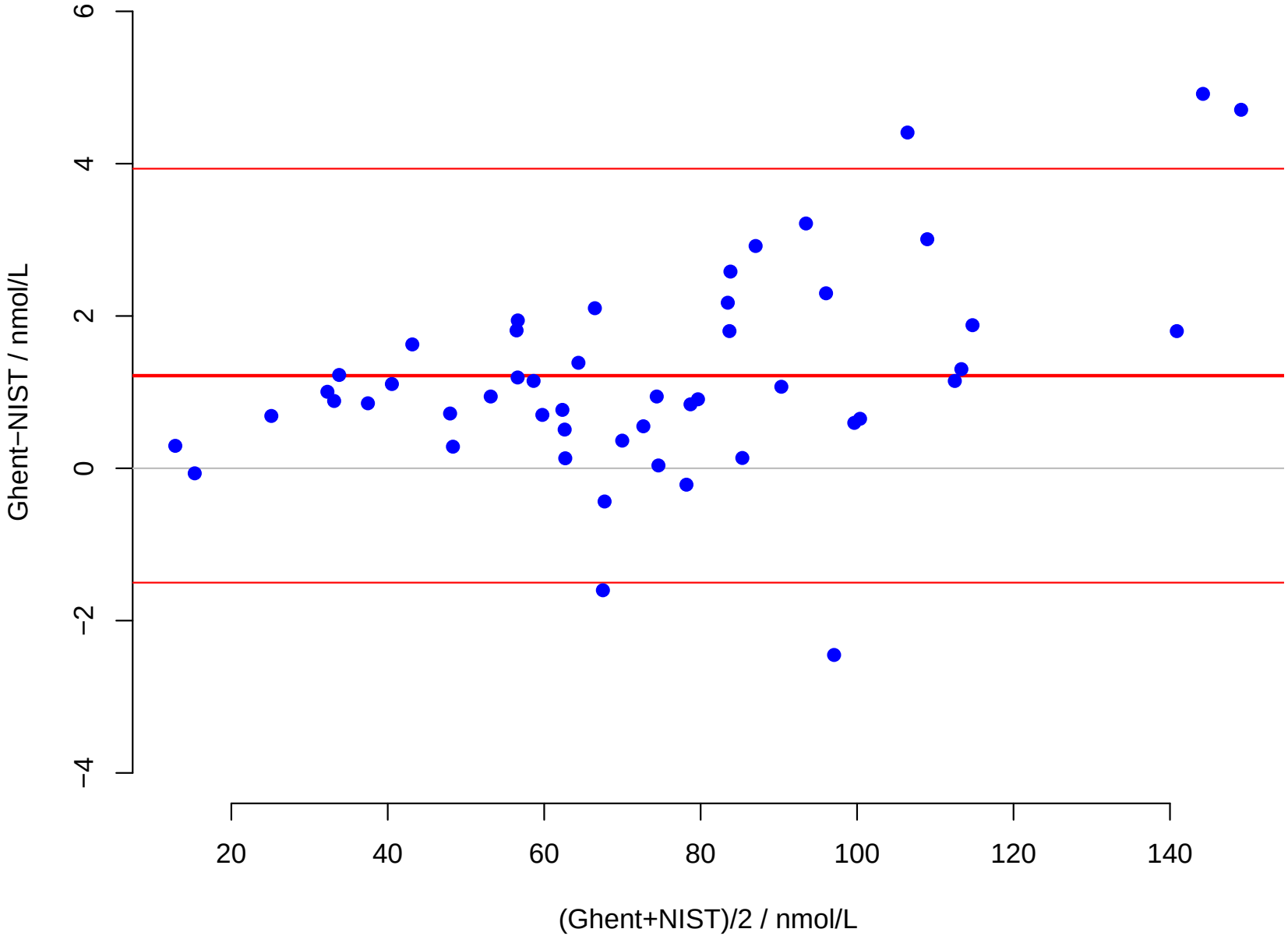
UNITS OF MEASUREMENT

- Determinations made by NIST converted from $\mathrm{ng\,g^{-1}}$ to $\mathrm{ng\,mL^{-1}}$ using values of serum density measured by Ghent
- All values, from Ghent and from NIST, converted from $\mathrm{ng\,mL^{-1}}$ to $\mathrm{nmol\,L^{-1}}$ by multiplication by
  - 2.423 (for $25(OH)D_2$)
  - 2.496 (for $25(OH)D_3$ and for 3-epi-$25(OH)D_3$)

VDSP Single Donor Samples — Total 25(OH)D



VDSP Single Donor Samples

VALUE ASSIGNMENT

- Determined by agreement between relevant parties:
  - Values of $25(OH)D_2$ and $25(OH)D_3$ assigned to each sample: average of averages of determinations made by Ghent and by NIST
  - Total concentration of $25(OH)D$: calculated separately for each lab as sum of lab's average concentrations of $25(OH)D_2$ and $25(OH)D_3$

    Considering also the values for $25(OH)D_2$ that were below the LoQ
  - Values assigned to $3\text{-epi-}25(OH)D_3$: averages of determinations made by NIST only

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BIAS ASSESSMENT

- Biases estimated by differences between averages of replicated determinations of same measurand in NIST SRM 972
- None of the biases differ significantly from 0, either statistically or substantively

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REFERENCE MATERIALS USED FOR CALIBRATION

- Reference materials used for calibration, quality assurance, and bias assessment all from NIST SRM 972 — uncertainties associated with reference values need to be propagated and expressed

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UNCERTAINTY EVALUATION (1/2)

For each single donor sample:

- Compute averages $\overline{x}_{\mathrm{G}}$ and $\overline{x}_{\mathrm{N}}$
- Compute associated standard uncertainties $u(\overline{x}_{\mathrm{G}}) = s_{\mathrm{G}}/\sqrt{n_{\mathrm{G}}}$ and $u(\overline{x}_{\mathrm{N}}) = s_{\mathrm{N}}/\sqrt{n_{\mathrm{N}}}$
- Assigned value $x = \frac{1}{2}(\overline{x}_{\mathrm{G}} + \overline{x}_{\mathrm{N}})$
- Uncertainty component attributable to within-laboratory dispersion of values $u_{\mathrm{WD}}(x) = \frac{1}{2}\sqrt{u^2(\overline{x}_{\mathrm{G}}) + u^2(\overline{x}_{\mathrm{N}})}$
- Corresponding number of degrees of freedom given approximately by Welch-Satterthwaite formula

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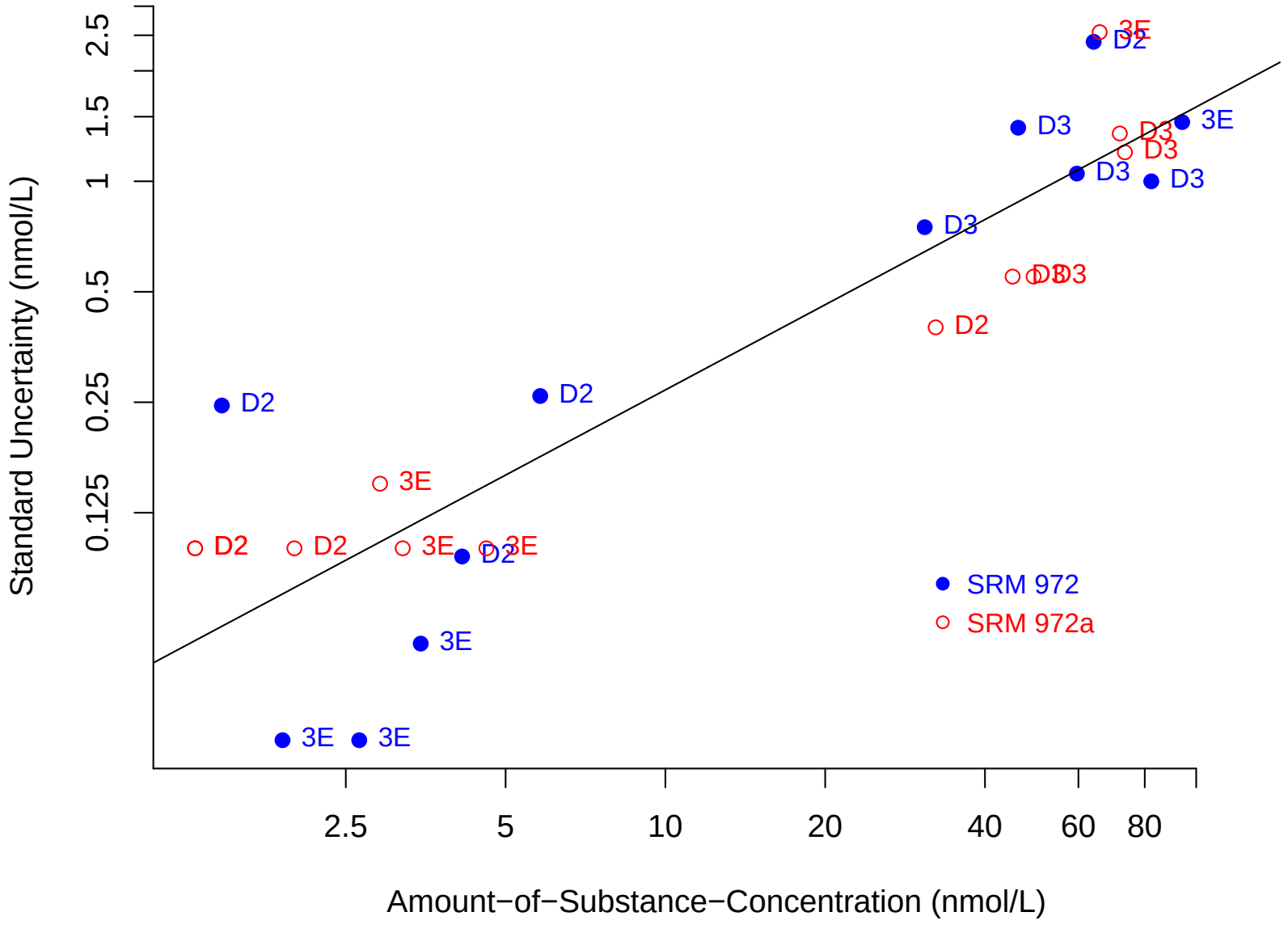
UNCERTAINTY CONTRIBUTION FROM CALIBRATION



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UNCERTAINTY EVALUATION (2/2)

- Component of uncertainty $u_C(x)$ attributable to calibration obtained by interpolation from relationship between uncertainty and value for SRMs 972 and 972a
- Combined standard measurement uncertainty $u(x) = \sqrt{u_{WD}^2(x) + u_C^2(x)}$, with corresponding number of degrees of freedom ν computed using Welch-Satterthwaite formula
- Approximate 95 % coverage interval for the value of the measurand is $x \pm t_{\nu,0.975} u(x)$

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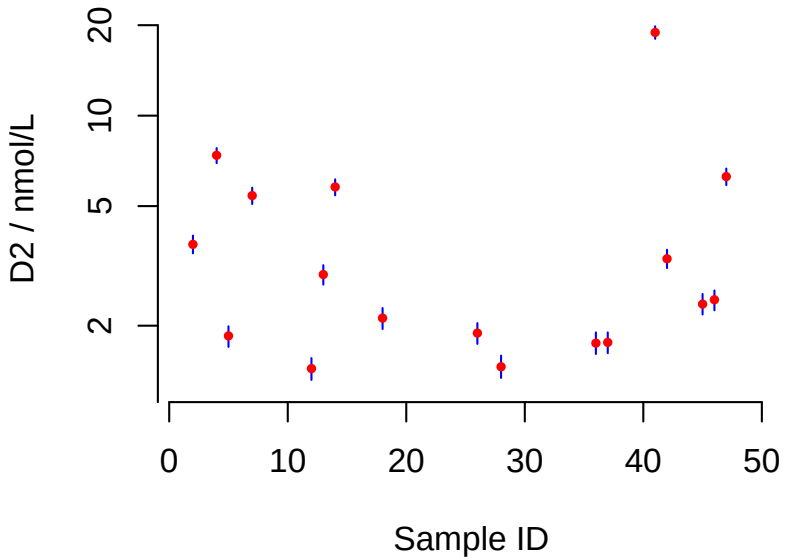
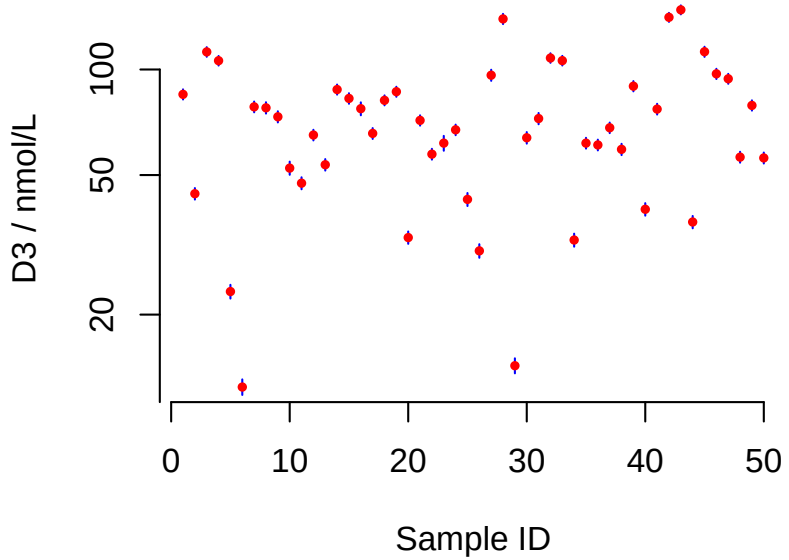
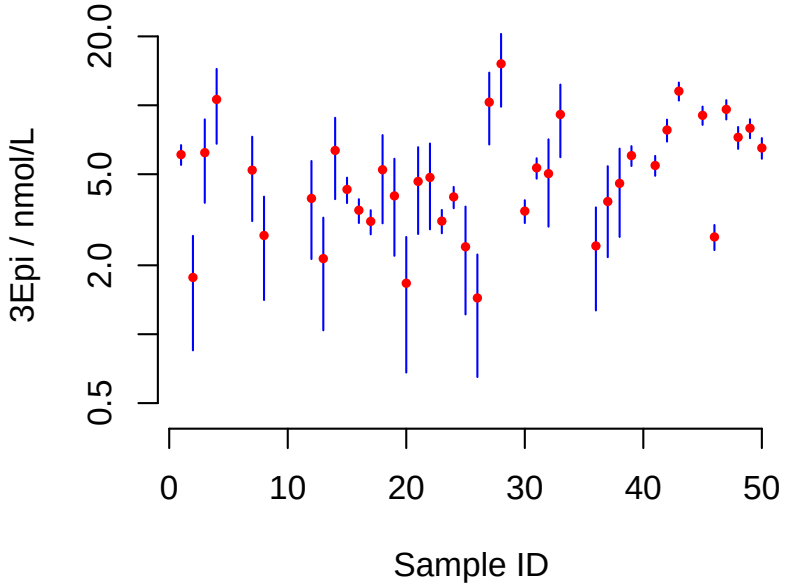
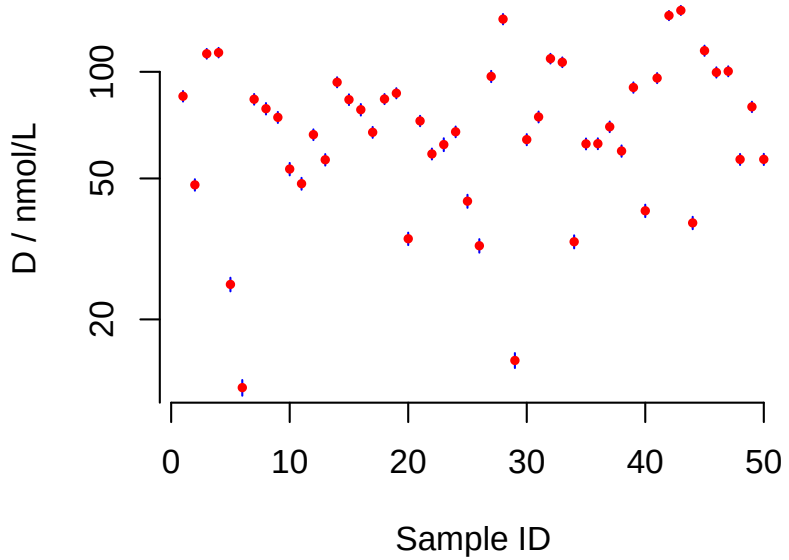
RESULTS









VDSP Commutability Study — 25(OH)D_3